

Using Assigned Protection Factors (APFs) for Respirator Selection

Use with Chapter 296-842 WAC, Respirators

Important!

Use this tool if you need help using the APFs in Table 5 of Chapter 296-842 WAC, Respirators.

- This tool is designed to compare hazard ratios (these are values that rate the level of employee protection needed) to APFs (these are values that rate the expected level of protection provided by different types of respirators under ideal conditions) to determine which respirator types are acceptable pending further selection criteria in Chapter 296-842 WAC, Respirators.

If exposure circumstances in your workplace aren't addressed by this tool, contact your local WISHA consultant.

- See www.lni.wa.gov/wisha/consultation for a list of consultants to assist you
or
- Go to the Resources section of Chapter 296-800 WAC, Safety and Health Core Rules, for a list of service locations in your area

Step 1: Make sure you start by having this information available:

- Estimated or measured employee exposure concentration values for each respiratory hazard identified during your exposure evaluation.

Reference:

See Chapter 296-841 WAC, Respiratory Hazards, if you haven't completed an exposure evaluation.

- WISHA's permissible exposure limit (PEL) value.
 - There are 3 types of PEL values:
 - 8-hour, time-weighted average (TWA₈) value
 - Short-term exposure limit (STEL) value
 - Ceiling (C) limit value
 - You only need the PEL values that exposure evaluation results show are exceeded. For example, if employee exposure concentrations exceed the TWA₈, but **not** the STEL or Ceiling limit, you will only need the TWA₈ value.

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Step 2: Calculate hazard ratio values for **each** substance using this formula:

$$\text{Hazard ratio} = \frac{\text{Concentration in ppm (or mg/ M}^3\text{)}}{\text{PEL in ppm (or mg/ M}^3\text{)}}$$

- Use **Table HT-1** to define the terms in the formula.

Table HT-1 Key to Formula symbols	
<i>The term</i>	<i>Is the</i>
Concentration	Estimated or measured concentration of the respiratory hazard during an 8-hour or a short-term exposure period, determined during your hazard evaluation
PEL	WISHA Permissible Exposure Limit (PEL) established for the substance
*ppm	Concentration units in parts per million
*mg/ M ³	Concentration units in milligrams per cubic meter
*Concentration units (ppm or mg/ M ³) used in the formula for "Concentration" and "PEL" must be the same. If they are different, contact your local WISHA consultant or your laboratory to get help with converting your "Concentration" value.	

- Calculate the hazard ratio, using the formula, for 8-hour exposure periods when exposures exceed the WISHA TWA₈ value.
- Calculate the hazard ratio, using the formula, for short-term exposure periods when exposures exceed the WISHA STEL value.
- If you are uncertain about this step, review this example:

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Example 1: Your employees are exposed to a **single** airborne substance.
Calculate hazard ratios based on the information in **Table HT-2**.

Table HT-2
Example 1: Exposure Evaluation Information

- WISHA's PELs for the substance are:
 - 50 mg/M³ = TWA₈
 - 150 mg/M³ = STEL
- Your hazard evaluation results show employees are exposed to the substance at concentrations above WISHA's TWA₈ and STEL. These results are reported as:
 - 300 mg/M³ averaged over an 8-hour exposure period
 - 600 mg/M³ averaged over a 15-minute (short-term) exposure period

You will need to calculate 2 hazard ratio values since evaluation results show employees are exposed above WISHA's TWA₈ and STEL.

Put the **8-hour** values for "PEL" and "Concentration" into the formula and calculate the hazard ratio

$$\frac{\text{Concentration}}{\text{PEL}} = \frac{300 \text{ mg/M}^3}{50 \text{ mg/M}^3} = \text{A hazard ratio of 6 for the 8-hour exposure period}$$

Put the **short-term** values for "PEL" and "Concentration" into the formula and calculate the hazard ratio

$$\frac{\text{Concentration}}{\text{PEL}} = \frac{600 \text{ mg/M}^3}{150 \text{ mg/M}^3} = \text{A hazard ratio of 4 for the short-term exposure period}$$

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Step 3: If the respiratory hazard is a **single** substance, select the highest hazard ratio value and skip to Step 6.

If the respiratory hazard is a **mixture** of substances, you'll need to determine if substances in the mixture have additive health effects. After this determination, go to Step 4.

Reference:

If you haven't evaluated the substances to find out if they have additive health effects, follow the guidance in Steps 1 & 2 of the **Mixtures of Substances** Helpful tool, located in the Resources section of Chapter 296-842 WAC, Respirators.

Step 4: If substances in the mixture do **not** have additive health effects, select the highest hazard ratio value and skip to Step 6.

Step 5: When substances in the mixture have additive health effects, add up the hazard ratio values of exposure periods to get a total value for each exposure period. Select the highest hazard ratio total.

If you are uncertain about this step, review this example:

Example 2:

- Employees are exposed to a mixture of 2 substances with additive health effects. Select the highest hazard ratio total.
- Hazard ratios for each substance and totals for each exposure are shown in **Table HT-3**.
- The highest ratio total is 15.

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<i>Table HT-3</i>		
<i>Example 2: Hazard Ratios and Totals</i>		
<i>Identity of the substance</i>	<i>Hazard Ratios for the 8- hour exposure period</i>	<i>Hazard ratios for the short-term exposure period</i>
Substance 1	10	4
Substance 2	5	1
	Total = 15	Total = 5

Step 6: Compare your hazard ratio value to the APF values in Table 5 of Chapter 296-842 WAC, Respirators.

and

Note any respirator types in Table 5 with an APF **equal or more than** your hazard ratio.

- These respirator types are capable of providing a sufficient protection level for your workplace exposure concentrations; **however**, other selection requirements found in WAC 296-842-13005, Select and Provide Appropriate Respirators, must be followed to determine your final respirator selection outcome.

If you are uncertain about this step, review these examples:

Example 3:

- A hazard ratio of 3 has been determined.
- Which respirator types are acceptable for further selection consideration?
 - All APFs shown in Table 5 of Chapter 296-842 WAC, Respirators, have an APF that's more than 3, so all types of respirators are acceptable for further selection consideration.

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Example 4:

- A hazard ratio of 12 has been determined.
- Which respirator types are acceptable for further selection consideration?
 - Respirator types shown in Table 5 of Chapter 296-842, Respirators, with an APF of 25 or more, are acceptable for further selection consideration. In this case, all other respirators must be excluded from your selection process.

